CLAIMS

WE CLAIM:

1. A charging system for an unmanned underwater vehicle, comprising:

an electrical port adapted to electrically couple to an unmanned underwater vehicle (UUV);

a fuel source;

a fuel cell adapted to selectively receive fuel from the fuel source and configured, upon receipt thereof, to generate electrical power; and

a controller adapted to receive a UUV docking signal that indicates at least when the electrical port is electrically coupled to at least a portion of the UUV and operable, in response thereto, to (i) selectively fluidly couple the fuel cell to the fuel source and (ii) selectively electrically couple the fuel cell to the electrical port.

2. The system of Claim 1, further comprising:

a battery,

wherein the controller is further adapted to receive one or more signals representative of at least a state of charge of the battery and is further operable, in response thereto, to (i) selectively fluidly couple the fuel cell to the fuel source and (ii) selectively electrically couple the fuel cell to the battery, to thereby recharge the battery to a predetermined state of charge.

3. The system of Claim 1, further comprising:

a data transfer module adapted to receive data from the UUV and transfer the received data to data receptor.

4. The system of Claim 3, wherein the data transfer module is electrically coupled to receive power from either, or both, the battery or fuel cell.

5. The system of Claim 1, further comprising:

a UUV docking control module adapted to receive a signal representative of the docking status of the UUV and operable, in response thereto, to supply the UUV docking signal.

6. The system of Claim 5, wherein the UUV docking control module is electrically coupled to receive power from either, or both, the battery or fuel cell.

7. The system of Claim 1, wherein the fuel source comprises:

a tank; and

one of hydrogen and a hydrocarbon stored therein.

8. The system of Claim 1, wherein the controller is further operable, in response to the UUV docking signal, to supply one or more valve position command signals, and wherein the system further comprises:

a conduit disposed between the fuel source and the fuel cell;

a valve mounted on the conduit and moveable between a closed position, in which the fuel source is not in fluid communication with the fuel cell, and an open position, in which the fuel source is in fluid communication with the fuel cell; and

a valve actuator coupled to receive the valve position command signals from the controller, and further coupled to the valve, the valve actuator responsive to the valve position command signals to move the valve between the closed and open positions.

9. The charging system of Claim 1, wherein the controller is further operable, in response to the UUV docking signal, to supply one or more switch command signals, and wherein the system further comprises:

a switch coupled between the electrical port and the fuel cell and moveable between an open position, in which the fuel cell is not electrically coupled to the electrical port, and a closed position, in which the fuel cell is electrically coupled to the electrical port,

wherein the switch is further coupled to receive the switch command signals and is operable, in response thereto, to selectively move between the open and closed positions.

10. The charging system of Claim 1, wherein the controller is further coupled to receive a signal that indicates a type of rechargeable power source that is on-board the UUV and is further operable, in response thereto, control a recharge operation of the rechargeable power source based at least in part on the power source type.

11. A docking station for an unmanned underwater vehicle (UUV), comprising:

a housing;

a UUV docking port disposed within the housing and configured to dock a UUV therein;

an electrical port disposed at least partially within the UUV docking port, the electrical port adapted to electrically couple to a docked UUV;

a fuel source coupled to the housing;

a fuel cell disposed within the housing, the fuel cell adapted to selectively receive fuel from the fuel source and configured, upon receipt thereof, to generate electrical power; and

a charge controller adapted to receive a UUV docking signal that indicates at least when the electrical port is electrically coupled to the docked UUV and operable, in response thereto, to (i) selectively fluidly couple the fuel cell to the fuel source and (ii) selectively electrically couple the fuel cell to the electrical port.

12. The UUV docking station of Claim 11, further comprising:

a sensor adapted to sense at least when a UUV is properly docked in the UUV docking port, and configured to supply a sensor signal representative thereof;

a UUV docking controller coupled to receive the signal from the sensor and operable, in response thereto, to supply the UUV docking signal to the charge controller.

13. The UUV docking station of Claim 11, further comprising:

a sensor adapted to sense at least when a UUV is properly docked in the UUV docking port, and configured to supply a sensor signal representative thereof to the charge controller,

wherein the sensor signal is the UUV docking signal.

14. The UUV docking station of Claim 11, further comprising:

a battery,

wherein the charge controller is further adapted to receive one or more signals representative of at least a state of charge of the battery and is further operable, in response thereto, to (i) selectively fluidly couple the fuel cell to the fuel source and (ii) selectively electrically couple the fuel cell to the battery, to thereby recharge the battery to a predetermined state of charge.

15. The UUV docking station of Claim 11, further comprising:

a data transfer module adapted to receive data from the UUV and transfer the received data to data receptor.

16. The UUV docking station of Claim 15, wherein the data transfer module is electrically coupled to receive power from either, or both, the battery or fuel cell.

17. The UUV docking station of Claim 11, further comprising:

a UUV docking control module adapted to receive a signal representative of the docking status of the UUV and operable, in response thereto, to supply the UUV docking signal.

18. The UUV docking station of Claim 17, wherein the UUV docking control module is electrically coupled to receive power from either, or both, the battery or fuel cell.

19. The UUV docking station of Claim 11, wherein the fuel source comprises:

a tank; and

one of hydrogen and a hydrocarbon stored therein.

20. The UUV docking station of Claim 11, wherein the charge controller is further operable, in response to the UUV docking signal, to supply one or more valve position command signals, and wherein the system further comprises:

a conduit disposed between the fuel source and the fuel cell;

a valve mounted on the conduit and moveable between a closed position, in which the fuel source is not in fluid communication with the fuel cell, and an open position, in which the fuel source is in fluid communication with the fuel cell; and

a valve actuator coupled to receive the valve position command signals from the charge controller, and further coupled to the valve, the valve actuator responsive to the valve position command signals to move the valve between the closed and open positions.

21. The UUV docking station of Claim 11, the charge controller is further operable, in response to the UUV docking signal, to supply one or more switch command signals, and wherein the system further comprises:

a switch coupled at least between the electrical port and the fuel cell and moveable between an open position, in which the fuel cell is not electrically coupled to the electrical port, and a closed position, in which the fuel cell is electrically coupled to the electrical port,

wherein the switch is further coupled to receive the switch command signals and is operable, in response thereto, to selectively move between the open and closed positions.

22. The UUV docking station of Claim 11, wherein the charge controller is further coupled to receive a signal that indicates a type of rechargeable power source that is on-board the UUV and is further operable, in response thereto, control a recharge operation of the rechargeable power source based at least in part on the power source type.

23. A method of charging a power source in an unmanned underwater vehicle (UUV), comprising the steps of:

electrically coupling an electrical port to at least a portion of the UUV power source;

supplying fuel to a fuel cell that is configured to generate electrical power upon receipt of the fuel; and

electrically coupling the fuel cell to the electrical port, to thereby charge the UUV power source using at least the fuel cell.

24. The method of Claim 23, further comprising:

determining a state of charge of a battery; and

based at least in part on the determined state of charge, selectively supplying the fuel to the fuel cell and selectively electrically coupling the fuel cell to the battery, to thereby recharge the battery to a predetermined state of charge.

25. The method of Claim 23, further comprising:

determining a docking status of the UUV.

26. The method of Claim 23, further comprising:

transferring data from the UUV while charging the UUV power source.

27. The method of Claim 23, wherein the UUV power source is one of a plurality of types of power sources, and wherein the method further comprises:

determining the type of rechargeable power source; and

charging the UUV power source based at least in part on its type.